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NP10 8QQ

I the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents originally filed in connection with patent application GB0122082.1 filed on 13 September 2001.

I also certify that the attached copy of the request for grant of a Patent (Form 1) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Signed

Dated 23 March 2009

Patents Form 1/77

Patents Act 1977
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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

THE PATENT OFFICE
13 SEP 2001
RECEIVED

The Patent Office
Cardiff Road
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South Wales
NP10 8QQ

1. Your reference

0122082.1

13SEP01 E659534-1 C77543
P01/7700 0.00-0122082.1

2. Patent application number
(The Patent Office will fill in this part)

13 SEP 2001

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

DANIEL JAMES PLANT
LLANWINNEY FARM
LLANGOVAN
NR. MONMOUTH
NP25 4BU.

Patents ADP number *(if you know it)* 7659808001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

ENERGY ABSORBING MODULES

5. Name of your agent *(if you have one)*

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EC1A 7DH

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Patents ADP number *(if you know it)*

FS1/7
17/10

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	3
Claim *(s)*	
Abstract	
Drawing *(s)*	2 only

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Dan Plant Date 12/09/2001

12. Name and daytime telephone number of person to contact in the United Kingdom Dan Plant 01600 860 550

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.

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d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.

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Energy Absorbing Modules

Body impact protection solutions currently available are limited because they are either based upon a rigid exterior shell (for example as used in roller blade pads), that are uncomfortable to wear, or upon some form of foam laminate (as used in ski pad inserts), which provide poor levels of protection. A protective member is known from Us 5138722 in which an energy absorbing material is contained in an envelope, the material remaining soft and flexible until it is subjected to an impact when its characteristics change rendering it temporarily rigid.

It is the object of the present invention to provide an energy absorbing member that is both flexible and lightweight and would produce a form for impact solutions. It is a further object of the invention to provide an energy absorbing sheet that can be permanently attached and tailored into a garment of part thereof. It is a further object of the invention that the sheet could be simple to cut into the required size and shape, and subsequently attached within or onto the garment.

According to the invention there is provided a sheet comprising of an energy absorbing material in the form of a 'module' that may be placed within a sheet. The energy absorbing material is made into these forms, hereafter called the 'modules'. These could be of any shape. These modules could be formed in a similar manner to the way lead shot is manufactured. In this embodiment they would be spherical. The energy absorbing material could be dripped out of a container to form these spheres. The modules of energy absorbing material could also be extruded out of a die in any shape, circular, square, star or even tube and then cut to the required length. These modules of material could then skin over when exposed to the appropriate conditions, in the same way that an open container of paint would skin over when left in contact with air. The module would then consist of the energy absorbent material encapsulated in a thin skin of the same material.

A further way of producing the modules is to encapsulate the energy absorbent material within a suitable encapsulant. This could be sprayed on to coat the modules. This could happen whilst the modules fall out of the machine which formed their original shape. The modules could be sprayed whilst they drop out of the 'lead shot' type device whilst falling. The modules could also by sprayed whilst falling out of the extruder. An alternative to spraying the modules would be to coat them in encapsulant in another process. Such a process could allow them to fall in to a vat of encapsulant to become fully coated. This would be similar to the way that liquid latex slowly sets onto the side of part placed into it.
This could either be in liquid state that will dry later, or in molten/liquid state so that the coated modules will be sealed upon being removed. The amount of time that the modules are subjected to such an encapsulating procedure could determine the thickness of the layer of encasulant. They could be removed in some continuous process.

The modules could undergo a large temperature change after being formed. This would help then to remain in there original module shape while a different encapsulation technique was used. This could be compared to the hailstones, which are drops of water that have been frozen, thus remaining in their robust solid state until they thaw out. In this way the modules would keep there shape for longer. This would help any subsequent encapsulation technique. It may be possible to roll the modules in a dust type coating which is then very quickly heated to for an encapsulated layer in a similar way to powder coating techniques.

The modules could then be grouped and held into a protective form. This could be of any size. These modules could be placed in a required textile form. They could also be placed in a flexible container similar to the way that small spheres are held in beanbags. The modules could also be held within the central structural part of some of the latest spacer fabrics. They could also be sewn in between two layers of material. This material would preferably be soft and flexible, preferably a textile. They could be held in this way in the same manner as Thermo-tex. This from could also be made like a pocketed quilt.
The energy absorbing member containing the modules would remain soft and flexible until subjected to an impact when its characteristics change rendering it temporarily rigid, the member returning to its normal flexible state after said impact.

Preferably the energy absorbing material within the modules absorbs the impact force and spreads the load thereof during the impact. Preferably the energy absorbing material within the modules is a strain rate sensitive material such as a dilatent compound whose mechanical characteristics change upon impact. The preferred material would be a lightweight version of the strain rate sensitive material including one or more dualite spheres. The preferred material is a Dimethyl siloxane hydroterminated polymer such as the material sold by Dow Corning under the Catalogue or trade number 3179 or lightweight version thereof.

Preferably the modules of the material that are not encapsulated but are contained by there own skin are made from a dilatent compound, or derivative thereof. This skin could form by exposing the raw modified dilatent to the correct conditions. For example exposing the material to air, or dipping the material in another material, or exposing the material to ultraviolet light, thus causing a skin to be formed. The family of silicone compounds are known to form a skin but still remain flexible at the core. One example of this would be standard silicone sealant.

Several embodiments of the invention will now be described, by way of example only with reference to the accompanying drawings.

Figure 1 is a cross section of forms of the module.
Figure 2 is a cross section of one form of the module.

Figure 3 is a cross section of a sheet of absorbing material made up from a number of random modules.
Figure 4 is a cross section of a sheet of absorbing material made up from a number of a matrix of modules.
Figure 5 is a cross section of a sheet of absorbing material made up from a number of a row of modules.

Figure 1 shows a cross section of different shaped modules. 1 is in a sphere shape. 2 is in a pill shape, 3 is in a rectangle shape, 4 is in a star shape, and 5 is in a triangular shape. This is just to help visualise the different types of module shapes that could be made.

Figure 2 shows module 4 which comprises of an energy absorbing material 2. This could be extruded as any shape and then cut to the required length. Encapsulated by material 5. Material 5 could be a different encapsulation material applied by either spraying or coating. Preferably material 5 would be a skin of the same material.

Another embodiment of a module which comprises of an energy absorbing material, but with a hollow. This could be extruded as normal and then cut to the required length. A further embodiment of the invention could include using gas at above atmospheric pressure to fill the hollow. Preferably this gas would be air.

Figure 3 shows another embodiment where the modules 9, as shown in either Figure 1 or 2, form a random 'frog-spawn' arrangement in the centre of a flexible energy absorbing sheet. Preferably this material would be a spacer material. The figure shows only modules in the centre of the spacer textile, but the modules could also be mixed with other materials. These could be dualite spheres or beads of foam. The materials on either side have been represented by the sheets 10. This material is preferably a textile. The spacer textile technology already available on the market can produce such multi layers of materials. The textile on either side would bind the sheet together. These bindings would be either in the form of cross links as is standard in spacer fabrics or sewn together. This would help to prevent migration of the modules from the centre of the sheet.

Figure 4 shows another embodiment where the modules 9, as shown in either Figure 1 or 2, form a row configuration in the centre of a flexible energy absorbing sheet. The materials on either side have been represented by the sheets 10. This material is preferably a textile. The spacer textile technology already available on the market can produce such multi layers of materials. The textile on either side would bind the sheet together.

Figure 5 shows another embodiment where the modules 9, as shown in either Figure 1 or 2, form a single row configuration in the centre of a flexible energy absorbing sheet. The materials on either side have been represented by the sheets 10. The module is made from energy adsorbing material 12. This is preferably a strain rate sensitive compound, dilatent material, or light weight version thereof. Another such embodiment could use a filling of lighter material in the centre of energy absorbing material, this could further help to reduce weight and cost. The energy absorbing material is then coated as shown by material 11.

FIG. 1

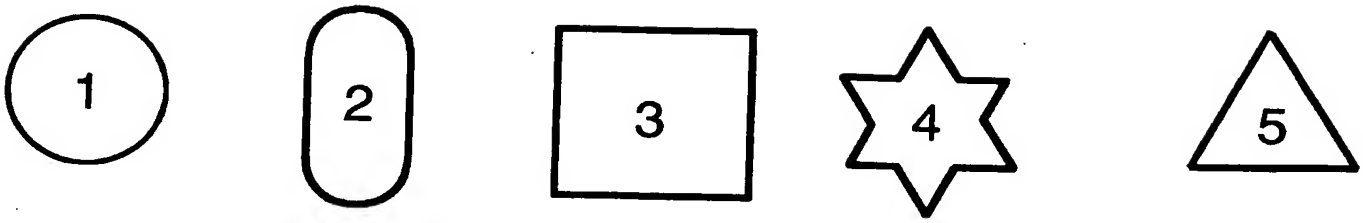

FIG. 2

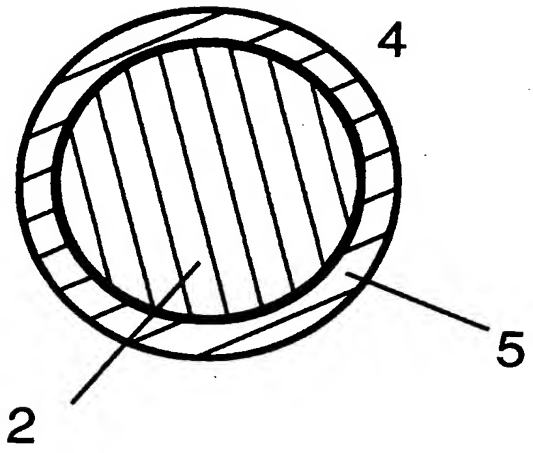

FIG. 3

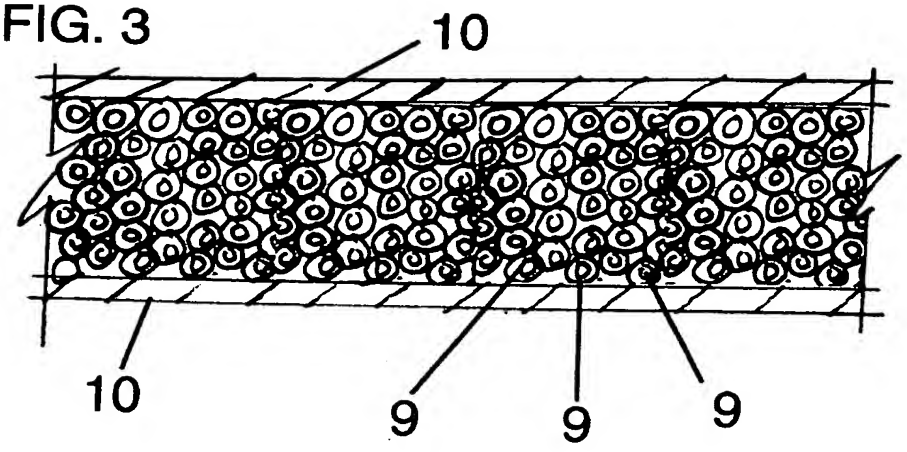

FIG. 4

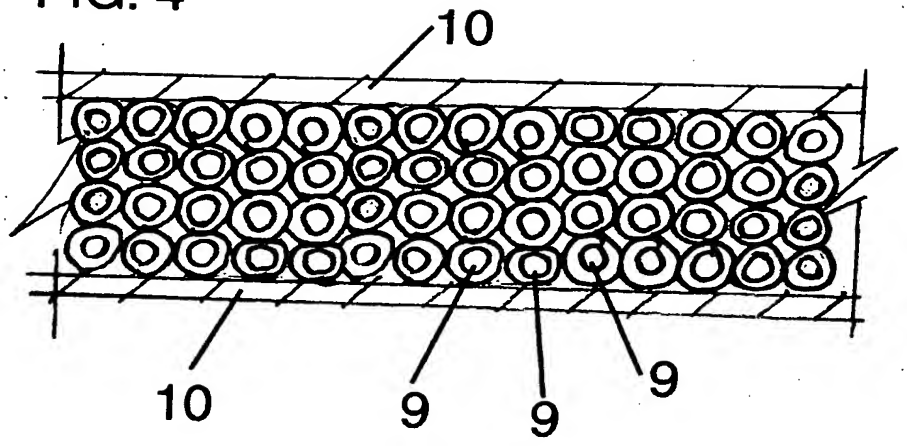

FIG. 5